https://doi.org/10.3301/ABSGI.2019.05

Parma 16-19 settembre 2019

ABSTRACT BOOK

a cura della Società Geologica Italiana

Congresso SIMP-SGI-SOGEI 2019

Il tempo del pianeta Terra e il tempo dell'uomo: Le geoscienze fra passato e futuro

PARMA 2020 la cultura batte il tempo | CAPITALE ITALIANA DELLA CULTURA

SOCIETÀ ITALIANA DI MINERALOGIA E PETROLOGIA SIMP

SOCIETÀ GEOLOGICA ITALIANA 1881 MENTE ET MALLEO

Società Geochimica Italiana So.Ge.I.

Interrelated changes in fluid sources and stress field orientation during the seismic cycle reconstructed for an exhumed analogue of the subduction megathrust shallow portion

Cerchiari A.*[1], Remitti F.[1], Mittempergher S.[2], Festa A.[3], Lugli F.[4] & Cipriani A.[1-5]

[1] Dipartimento di Scienze Chimiche e Geologiche, Università di Modena e Reggio Emilia.
[2] Dipartimento di Scienze dell'Ambiente e della Terra, Università di Milano Bicocca.
[3] Dipartimento di Scienze della Terra, Università di Torino.
[4] Dipartimento di Beni Culturali, Università di Bologna.
[5] Lamont-Doherty Earth Observatory of Columbia University, Palisades NY, USA.

Corresponding email: anna.cerchiari@gmail.com

Keywords: subduction megathrust, fluid source, seismic cycle.

We analysed the tectonic calcite veins of an exhumed thrust fault coming from a field analogue of the shallow portion (Tmax? 100°-150° C) of a subduction megathrust, the Sestola Vidiciatico Tectonic Unit (SVU) in the Northern Apennines of Italy (Vannucchi et al., 2008). Field observations show the cyclical formation of different deformation features with incompatible crosscutting relationships: low-angle thrust faults associated with mixed hybrid-shear- and implosion-breccia-type veins, extensional veins at low-angle to the thrust, and fault-normal extensional veins coupled with thrust-parallel pressure solution cleavage (Mittempergher et al., 2017).

Throughout laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) analyses, we document differences between REE patterns of extensional and shear veins, suggesting the involvement of different fluid sources during the seismic cycle. In shear veins, a strongly positive Eu^{2+} anomaly suggests an exotic fluid source, while the equilibrium with the fault zone environment of the fluid source of extensional veins, though partly modified by pressure-solution processes, suggests a more local circuit. The coupling of geochemical and structural data thus suggests a cyclical shifting of the principal σ_1 and σ_3 stresses through time, with interrelated changes in permeability, fluid pressure and composition, allowing to define three main seismic cycle phases: (i) a seismic phase, with brittle failure along thrust, crystallization of shear veins from a fluid external to the fault zone and a stress drop, determining the switch to the extensional regime; (ii) a post-seismic phase, with compaction perpendicular to the fault zone and formation of the fault-normal extensional veins from local fluids; (iii) a reloading phase, where the shear stress and the pore pressure are gradually restored, the stress field turns again to compression and fault-parallel extensional veins form, until a new brittle failure occurs.